Survey Report:

Lake Quinsigamond

Quinsigamond State Park

Part of a series of monitoring reports for DEM lakes and ponds

February 1995

Massachusetts Executive Office of Environmental Affairs
Department of Environmental Management
Office of Water Resources
Lakes and Ponds Program

William F. Weld, Governor ■ Argeo Paul Cellucci, Lt. Governor ■ Trudy Coxe, Secretary ■ Peter C. Webber, Commissioner

EXECUTIVE SUMMARY - 1994 Lake Quinsigamond Monitoring Report

A lake monitoring survey of Lake Quinsigamond was conducted on August 30 and 31, 1994 as part of the Massachusetts Department of Environmental Management's (DEM) Lakes and Ponds Program. The purpose of the survey was to (1) provide updated data on physical/chemical water quality, aquatic vegetation, and general watershed characteristics, and (2) identify management options for consideration in the DEM capital budget.

The limitations of this study (ie., limited sampling parameters, single sampling episode) constrain the extent to which conclusions and recommendations can be developed from the data and analyses in this report. However, problems identified included: (1) nutrient loading from Billings Brook and North inlet, (2) high specific conductance levels from Coal Mine Brook and O'Hara's Brook, (3) structural improvements needed at dam structures and at Lake Park Beach, (4) excessive macrophyte growth in many coves, including several non-native nuisance species. Management recommendations are as follows:

(1) **Target Pollution Sources:**

a) Sources of high total phosphorus measurements at Billings Brook and North inlet should be investigated for remediation.

b) To determine potential pollution sources leading to unusually high specific conductance measurements, more in-depth investigation and testing of Coal Mine Brook and O'Hara's Brook should be conducted.

(2) *Lake Park Beach Improvements:* To improve the quality of recreational access to Lake Quinsigamond, improvements to Lake Park Beach should be considered.

a) Regrading/beach nourishment is needed to improve the aesthetic and functional value of the beach area, which has eroded considerably in recent years.

b) The safety of the underwater walkway at Lake Park Beach should be improved. The walkway extends from the beach area into the lake, allowing bathers to walk out and stand in areas where the lake is quite deep. The walkway is fairly narrow, and drops off quickly to deep water on both sides. In the past, safety lines for bathers that are placed on either side of the walkway have been regularly cut down by power boats. The following steps should be considered:

* Improve the safety of the walkway by constructing a gradual dropoff on both sides.

* Improve the safety of bathers and boaters by placing a safety line system that 1) provides support to bathers, 2) is visible enough to deter boaters, 3) will not be destroyed if accidentally hit by a boat, and 4) will not pose a safety threat to passengers on such a boat.

(3) **Dam Improvements:** The catwalk at Irish Dam, which was vandalized several years ago, should be repaired or replaced. At Hovey Dam, metal walkway beams that were removed by vandals should be replaced.

(4) **Public Access Signs:** To prevent the further spread of non-native aquatic plants that are present in Lake Quinsigamond (such as Eurasian milfoil), educational signs should be placed at all public boat launching ramps around the lake. Signs are available from the Public Access Board, which instruct boaters to clean all plant fragments off boats, anchors , motors, and trailers before leaving the boat access.

(5) ***Public Education:*** In cooperation with the Lake Quinsigamond Commission, DEM should distribute copies of THE LAKE BOOK - Actions You Can Take To Protect Your Lake to homeowners around Lake Quinsigamond. This book is an excellent introduction to lake protection which is written specifically for lakefront property owners.

TABLE OF CONTENTS

I. INTRODUCTION

The Department of Environmental Management's (DEM) Lakes Management Program was established in 1992 to conduct lake/watershed assessments and develop management recommendations for lakes and ponds on DEM property. The program's goals are:

1. Assemble an interdisciplinary team to develop a comprehensive lake management program.

2. Conduct a lake and watershed assessment for ten DEM lakes each year, identifying the symptoms and causes of lake problems.

3. Develop management recommendations for each assessed lake/watershed, based on field data and input from Forests & Parks (F&P).

4. Provide DEM Senior Staff with a prioritized list of recommended actions required to maintain/improve the recreational and biological values of each assessed lake.

5. Train DEM Forest & Park (F&P) managers in techniques for assessing and managing lake problems.

6. Create a computerized database for all DEM lakes and ponds.

In 1994, two lakes from each of the five DEM regions were selected for assessment, based on prioritization by F&P regional staff. The following ten lakes were selected:

Region 1: Watson Pond (Watson Pond S.P.), Big Bearhole Pond (Massasoit S.P.)
Region 2: Frye Pond (Harold Parker S.F.), Cleveland Pond (Ames Nowell S.P.)
Region 3: Lake Cochituate (S.P.), Lake Quinsigamond (S.P.)
Region 4: Chicopee Reservoir (Chicopee Memorial S.P.), Lake Lorraine
Region 5: Benedict Pond (Beartown S.F.), Highland Lakes (D.A.R. S.F.)

Each lake was sampled for physical and chemical water quality, aquatic macrophytes, and general watershed characteristics. This report presents the data collected at Lake Quinsigamond on August 30 and 31, 1994, and provides management recommendations based on the data collected and discussions with staff of Quinsigamond State Park.

II. LAKE/WATERSHED BACKGROUND

General Information

Lake Quinsigamond is a 772 acre lake located in the Blackstone River basin between the city of Worcester and the town of Shrewsbury. The lake extends into the town of Grafton at its southern tip. The lake watershed and its major tributaries are illustrated in Figure 1, and bathymetric contours are shown in Figure 2. The lake has two distinct sections: the deep, narrow northern section known as Lake Quinsigamond and the shallow southern section known as Flint Pond. This report focuses on conditions at Lake Quinsigamond only, and does not assess Flint Pond.

The lake is situated in a highly urban area, and supports a variety of recreational uses, including fishing, boating, bathing, and water skiing. The entire periphery of the lake is highly developed with many private homes and several commercial establishments. Two state parks (Regatta Point Park, Lake Park Beach) and several private beaches and marinas are located along the shorefront.

The lake's major physical characteristics are as follows[1]:

Total area:	772 acres (Lake Quinsigamond = 475 acres, Flint Pond = 297 acres)
Maximum depth:	84 feet
Average depth:	21 feet (Lake Quinsigamond = 33 feet, Flint Pond = 9 feet)
Length:	approximately 5 miles
Width:	ranges from 250 feet to nearly a mile
Volume:	688 million cubic feet

Hydrology

The major inflow to Lake Quinsigamond is from a series of ponds north of the main body of the lake. The lake is also fed by 14 small tributaries. There is significant groundwater inflow into the lake, particularly in the summer and fall when surface flows are minimal.

Lake Quinsigamond has one outlet, located at the southern tip of Flint Pond at Irish Dam. The outflow is the source of the Quinsigamond River, which is a tributary of the Blackstone River.

[1] "Lake Quinsigamond Water Quality Study - 1971". Water Resources Commission, Boston (1971).

Geology/Soils[2]

The Lake Quinsigamond watershed can be described as a pre-glacial valley, bordered on the north, east, and south by glacial outwash deposits, which are primarily comprised of sand and gravel. The Sewall Hill area northeast of the lake is glacial till on top of bedrock. The area west of the lake on the Worcester shore is predominantly bedrock. The most significant aspect of the geology of the area is the predominance of glacial outwash, since its sand and gravel characteristics allow groundwater to reach the lake.

The soils in the Lake Quinsigamond watershed are characterized as follows:

* Hinckley-Merrimac-Windsor: Very deep, nearly level soils that are excessively drained and somewhat excessively drained; on outwash plains

* Urban land-Hinckley: Urban areas and very deep, nearly level to moderately steep soils that are excessively drained; on outwash plains

* Paxton-Woodbridge-Canton: Very deep, nearly level to steep soils that are moderately well drained; on uplands

Fisheries/Stocking History[3]

Lake Quinsigamond was surveyed in the early 1980's by the Division of Fisheries and Wildlife (DFW), with much subsequent survey work performed on bass, northern pike, and tiger muskellunge populations. The lake is a two story fishery supporting both warm and cold water species. The species composition includes: largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), chain pickerel (*Esox niger*), yellow perch (*Perca flavescens*), white perch (*Morone americana*), pumpkinseed (*Lepomis gibbosus*), bluegill (*Lepomis macrochirus*), carp (*Cyprinus carpio*), and banded killfish (*Fundulus diaphanus*). Rainbow smelt (*Osmerus mordax*) are also present, though in smaller numbers than in the past.

The lake gets a substantial stocking of trout annually, and has a decent holdover population. Surplus broodstock atlantic salmon (*Salmo salar*) have been stocked here since 1992. Northern pike (*Esox lucius*) were stocked in 1984, 1989, and 1993 and tiger muskellunge (*Esox lucius x Esox masquinongy*) were stocked in 1983 and 1987.

Lake Quinsigamond holds the current state record for common carp (42 lbs. in 1988), and held previous records for both northern pike and tiger muskellunge.

---

[2] Soil Survey of Worcester county, Massachusetts, Northern Part. Soil Conservation Service, 1985.

[3] Fisheries information was provided by the Department of Fisheries, Wildlife and Environmental Law Enforcement - Division of Fisheries and Wildlife.

III. DATA COLLECTION METHODS

Physical/Chemical Water Quality:

Lake Quinsigamond was sampled by staff of the DEM and the Division of Fisheries and Wildlife at eleven locations for temperature, pH, dissolved oxygen (DO), specific conductance, chlorophyll a, total alkalinity, total phosphorus, and ammonia-nitrogen. Water quality sampling station locations are shown in Figure 3. Lake water clarity was measured with a Secchi disk at the two deep hole stations (stations #1 and #10).

Temperature, pH, DO, and conductivity were measured *in situ* with a Hydrolab H2O. Surface measurements were recorded at all sampling stations, and additional measurements taken at one meter intervals near at the two deep holes until the lake bottom was reached.

To measure chlorophyll a, total alkalinity, total phosphorus, and ammonia-nitrogen, water samples were collected and transported to Conam Inspection, Inc. (Natick, MA) for laboratory analysis (all samples were stored in a cooler with ice until delivered to the laboratory). Surface grab samples were taken at all stations. Additional samples were taken with a Kemmerer sampler at 7.0m, 14.0m, and 23.0m at the two deep hole stations (station #1 and #10). Chlorophyll-a samples at the deep holes were collected with a 3/4 inch Tygon hose, to sample a composite of the water column to a depth of three times the Secchi disk transparency for the station being sampled.

All data and samples were collected using EPA protocols for the parameter under investigation. Analysis was conducted according to <u>Standard Methods for the Examination of Water and Wastewater (APHA, 1985)</u> and EPA protocols.

Aquatic Macrophyte Survey:

The aquatic macrophyton community in Lake Quinsigamond was sampled on August 30 and 31, 1994. Fifty-three randomly selected stations around the littoral zone of Lake Quinsigamond were surveyed for presence of macrophytic aquatic vegetation. Within a ten meter radius of each station, visual identifications were made and the lake bottom was dragged for aquatic vegetation using a weighted grappling hook. Most plant identifications were made "in situ". Some samples were bagged for later identification according to <u>A Manual of Aquatic Plants</u> (Fasset, 1957) or <u>Aquatic Vascular Plants of New England</u> (Hellquist and Crow, 1982), and some were sent to the Department of Environmental Protection - Office of Watershed Management for identification by Rick McVoy and Bob Haynes. Some plants could not be keyed to species because they were not in flower or fruit.

IV. LAKE SURVEY RESULTS and ANALYSIS

Physical/Chemical Water Quality Results and Analysis:

The water quality data presented in Tables 3 and 4 represent conditions at Lake Quinsigamond on August 31, 1994. Dissolved oxygen/temperature profiles for the two deep hole stations are presented in Figure 4. Because lake conditions for the parameters tested can change considerably with weather conditions, season, and other variables, a limited number a conclusions can be drawn from one set of sampling data. However, the following general water quality analysis should be noted:

* The **pH** readings for Lake Quinsigamond range from roughly neutral to mildly acidic. A pH of 7.0 is neutral, while values below 7.0 denote acidic waters and values above 7.0 denote basic waters. Most healthy lakes maintain a pH between 6.5 and 8.0. Fish cannot tolerate pH below 4 and above 11, and their growth and health is affected by long-term exposure to waters with pH less than 6.0 and greater than 9.5[4].

Most of the pH measurements for the lake and its tributaries fell within the "normal" range. The lake was slightly more acidic (between 6.4 and 6.2) between 8.0m and 22.5m at the North deep hole, and between 6.0m and 12.0m at the South deep hole. Lower pH measurements in the lake's deeper waters indicate decomposition reactions at the sediment-water interface. Regatta Point Park had a pH of 8.7, the only sample above 8.0.

* **Total alkalinity** measurements indicate that the lake is well buffered[5] and should have low sensitivity to acid deposition.

* **Specific conductance** measurements indicate the ability of water to conduct electricity, and measures the presence of ions in solution. Chloride is often the predominant ion found in surface waters. The primary anthropogenic sources ions in surface waters are often chlorides from wastewater and road salt. The primary natural sources of chloride are from the weathering of soils and rocks, and from wet and dry precipitation. Among the tributaries that were tested, particularly high specific conductance measurements were found at Coal Mine Brook (790 mS/cm) and O'Hara's Brook (494 mS/cm). Measurements from the two deep hole stations were highest near lake bottom, which indicates a release of ions from the sediments.

* **Dissolved oxygen:** Temperature profiles (Figure 6) for both deep hole stations depict summer thermal stratification. Dissolved oxygen levels decline rapidly at the thermocline between roughly 5 meters to 10 meters of depth, and the lake becomes almost completely anoxic below 10 meters.

---

4 Boyd, C.E., Water Quality for Pond Fish Culture. Elseviere Scientific Publications, pp. 318, 1982.

5 Taylor, J.W. ed. 1984. "The Acid Test", Natural Resources Magazine. Wisconsin Department of Natural Resources. 40 pp.

* Chlorophyll-a measurements indicate the amount of phytoplankton present in water, and are an indicator of lake fertility and trophic status. Particularly high chlorophyll-a measurements came from samples taken at Billings Brook (18.3 mg/m3), Quinsigamond Shores Condominiums (18.2 mg/m3), and the South Basin deep hole (18.9 mg/m3).

* Total Phosphorus concentrations at all sampling stations were generally between .01 mg/l and .04 mg/l. The only sample exceeding .04 mg/l was taken at the South Basin deep hole at 23.0 meters (.261 mg/l), which indicates a release of phosphorus from the sediments. Of the tributaries that were sampled, the highest total phosphorus concentrations were found at the North inlet (.036 mg/l) and Billings Brook (.036 mg/l).

Aquatic Macrophyte Survey Results and Analysis:

Tables 3 and 4 present the results of the macrophyte survey, and Figures 5 and 6 show the vegetation cover at each sampling station. The most prevalent species found were *Vallisneria americana* (water celery), several species of *Myriophyllum* (milfoil) including the non-native *Myriophyllum spicatum* (Eurasian milfoil), and *Najas flexilis*.

Macrophyte growth was sparse around much of the lake perimeter. Vegetation density at the fifty-three sampling stations can be categorized as follows:

Macrophyte Coverage	# of sampling stations
SPARSE: 0% - 25%	30
MODERATE: 25% -50%	6
DENSE: 50% -75%	5
VERY DENSE: 75% - 100%	12

* The predominant species throughout the lake was *Vallisneria americana* (water celery), which appeared at 35 sampling stations.

* The non-native *Myriophyllum spicatum* (Eurasian milfoil), one of the most aggressive and problematic plants found in Massachusetts waters, was found at 17 stations. This plant was most dense at the mouth of Tilly Brook, and in several coves in the South basin. Another species of milfoil, which was not identified, appeared at eight stations.

* Other frequently problematic plants that were found include *Najas flexilis* (11 stations), *Ceratophyllum demersum* (1 station), *Cabomba caroliniana* (1 station), and *Elodea sp.* (5 stations). Clumps of filamentous algae were present at 10 stations.

V. RECOMMENDATIONS

Based on lake survey data collected, discussions with staff at Quinsigamond State Park, and other information obtained during a general assessment of the Lake Quinsigamond watershed, the following management options are recommended:

(1) **Target Pollution Sources:**

* Sources of nutrient loading leading to high total phosphorus measurements at Billings Brook and North inlet should be investigated for remediation

* To determine potential pollution sources leading to unusually high specific conductance measurements, more in-depth investigation and testing of Coal Mine Brook and O'Hara's Brook should be conducted.

(2) **Lake Park Beach Improvements:** To improve the quality of recreational access to Lake Quinsigamond, improvements to Lake Park Beach should be considered.

a) Regrading/beach nourishment is needed to improve the aesthetic and functional value of the beach area, which has eroded considerably in recent years.

b) The safety of the underwater walkway at Lake Park Beach should be improved. The walkway extends from the beach area into the lake, allowing bathers to walk out and stand in areas where the lake is quite deep. The walkway is fairly narrow, and drops off quickly to deep water on both sides. In the past, safety lines for bathers that are placed on either side of the walkway have been regularly cut down by power boats. The following steps should be considered:

* Improve the safety of the walkway by constructing a gradual dropoff on both sides.

* Improve the safety of bathers and boaters by placing a safety line system that 1) provides support to bathers, 2) is visible enough to deter boaters, 3) will not be destroyed if accidentally hit by a boat, and 4) will not pose a safety threat to passengers on such a boat.

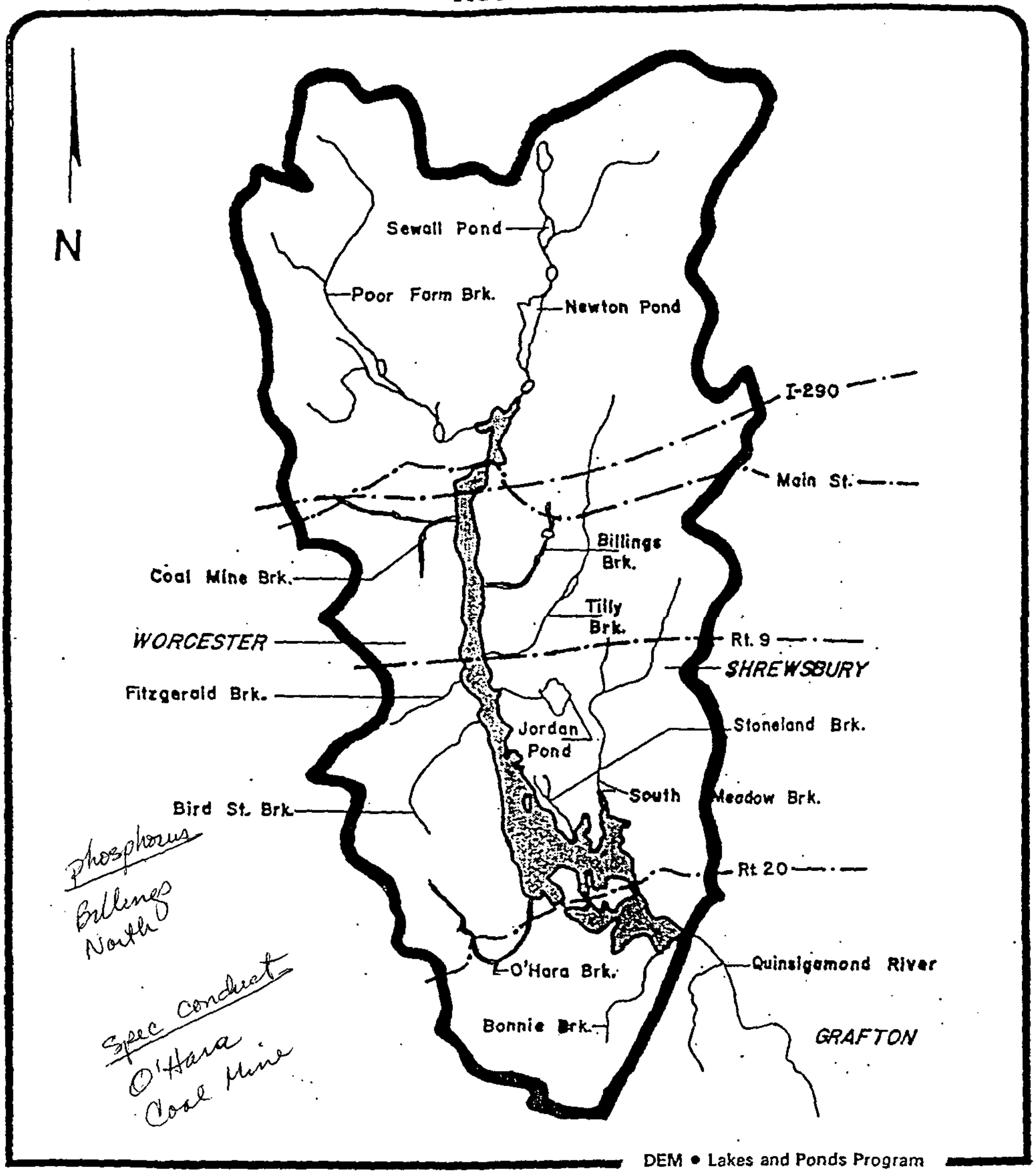
(3) **Dam Improvements:** The catwalk at Irish Dam, which was vandalized several years ago, should be repaired or replaced. At Hovey Dam, metal walkway beams that were removed by vandals should be replaced.

(4) **Public Access Signs:** To prevent the further spread of non-native aquatic plants that are present in Lake Quinsigamond (such as Eurasian milfoil), educational signs should be placed at all public boat launching ramps around the lake. Signs are available from the Public Access Board, which instruct boaters to clean all plant fragments off boats, anchors

, motors, and trailers before leaving the boat access.

(5) **Public Education:** In cooperation with the Lake Quinsigamond Commission, DEM should distribute copies of THE LAKE BOOK - Actions You Can Take To Protect Your Lake to homeowners around Lake Quinsigamond. This book is an excellent introduction to lake protection which is written specifically for lakefront property owners.

FIGURE 1

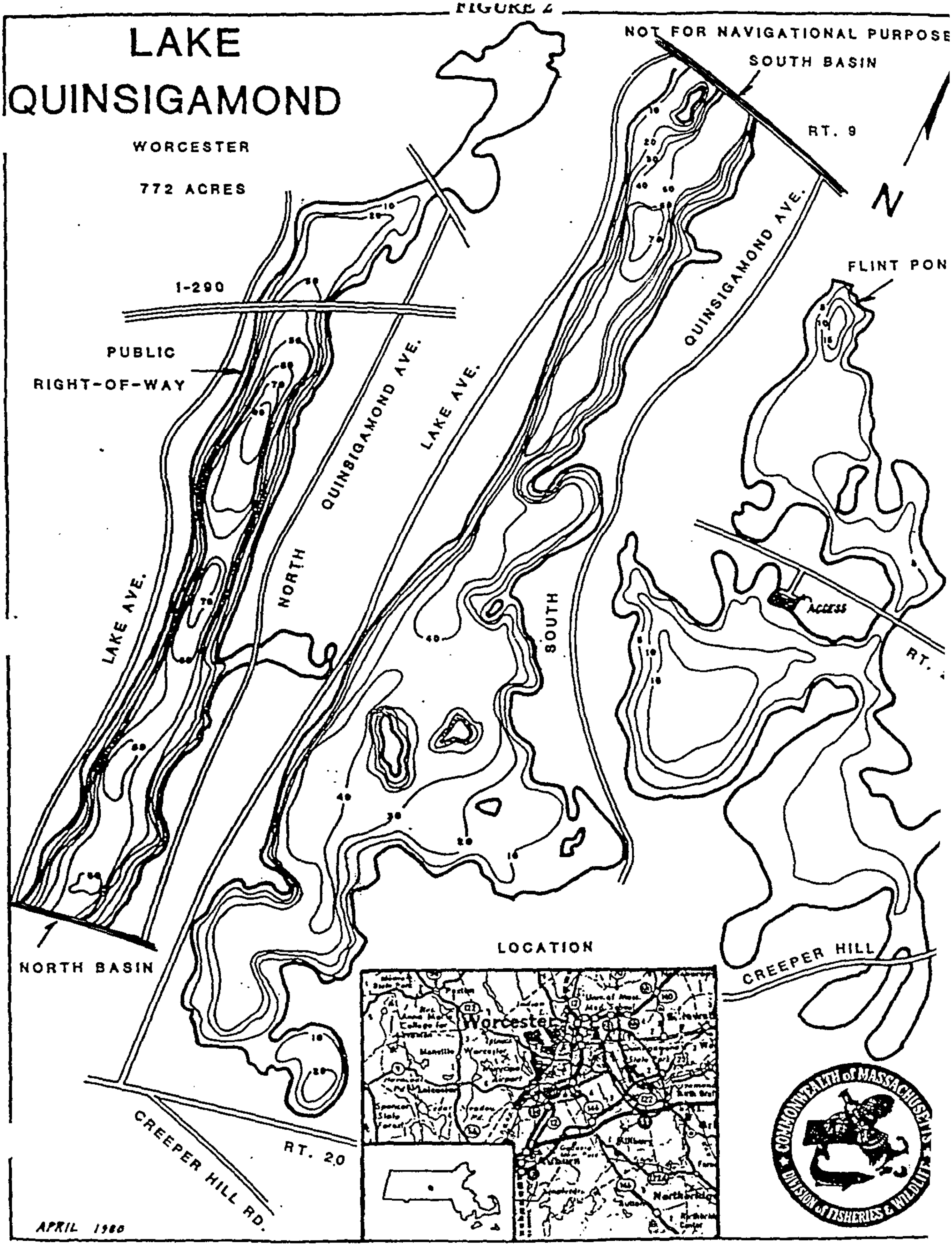


General Watershed Map

Lake Quinsigamond

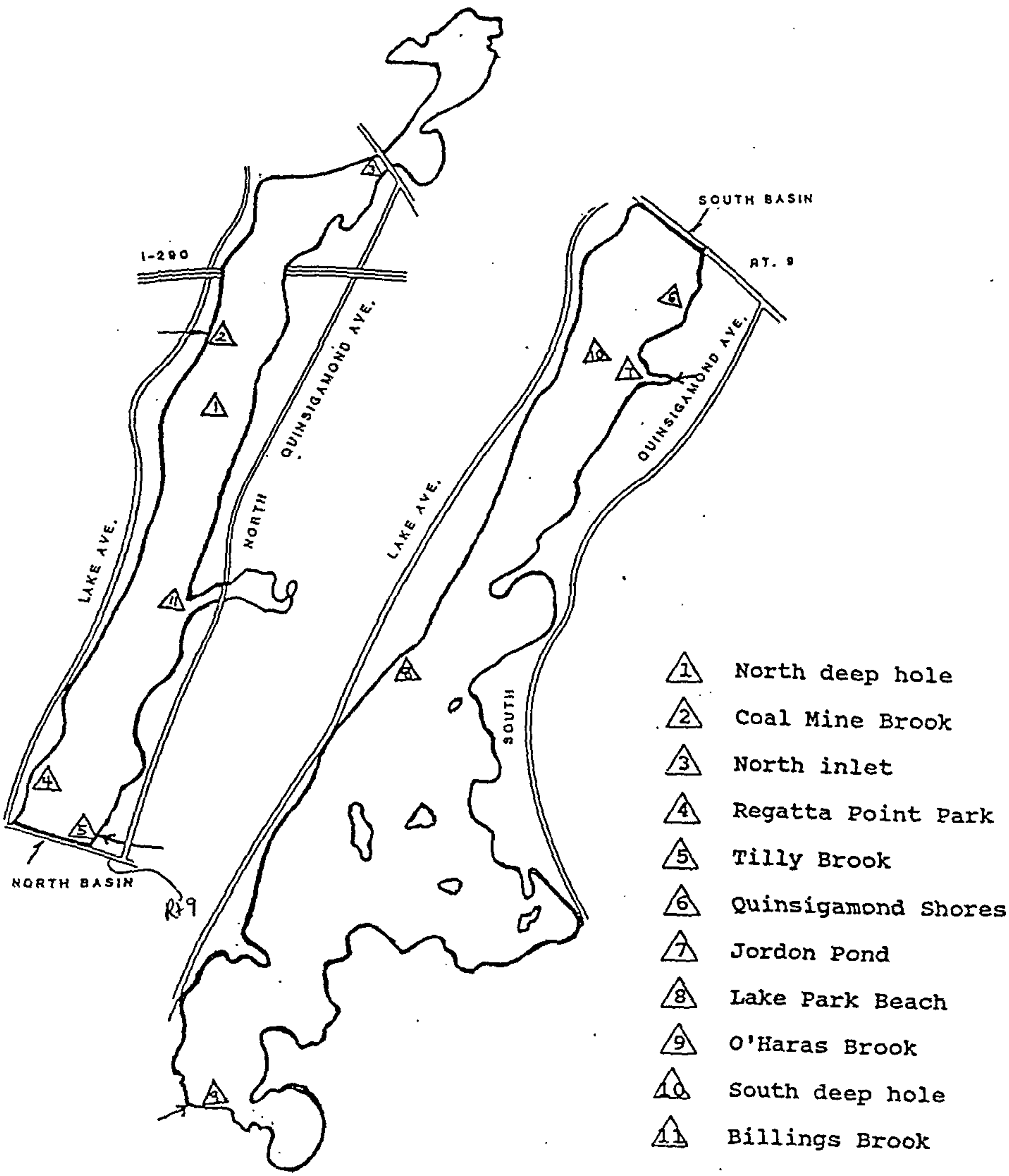
Worcester/Shrewsbury (Lake Area=772 acres)

FIGURE 2



LAKE QUINSIGAMOND
WORCESTER
772 ACRES
NOT FOR NAVIGATIONAL PURPOSE
SOUTH BASIN
RT. 9
N
FLINT POND
I-290
PUBLIC RIGHT-OF-WAY
QUINSIGAMOND AVE.
LAKE AVE.
NORTH
SOUTH
ACCESS
LAKE AVE.
NORTH BASIN
LOCATION
Worcester
CREEPER HILL
RT. 20
CREEPER HILL RD.
COMMONWEALTH of MASSACHUSETTS
DIVISION of FISHERIES & WILDLIFE
APRIL 1980

Figure 3



DEM • Lakes and Ponds Program

Water Quality Sampling Stations 8/31/94

Lake Quinsigamond-North/South Basins

Worcester/Shrewsbury-772 Acres (Total Lake)

Massacusetts Department of Environmental Management
Department of Resource Conservation
Lake and Pond Management Program

LAKE/POND SURVEY SHEET

Lake/Pond/Imp. Lake Quinsigamond Location Worcester/Shrewsbury

Drainage Basin Blackstone Date 8/31/94 Time 9:15 AM

Collectors Hartzel/Asen/Hartley/Laggacy

Secchi Disc Depth {3.5 m - North deep hole; 3.3 m - South deep hole} Air Temp. 24°C Cloud Cover 90%

Wind From South Wind Speed 10 mph Water Surface calm
(calm, rough, etc.)

Water Color brownish Water Odor none Water Level Normal
(normal, high, low)

Amount Suspended Sediment ~

Other Observed Substances none
(debris, wildlife, algae mats, oil film, etc.)

Lake Quinsigamond, 8/31/94

Sampling Station	Depth (m)	Chlor.-A (mg/m3)	Total Phos. (mg/l)	Total Alk. (mg/l)	Ammonia-N (mg/l)
#1 (North deep hole)	composite	6.69000			
	0.0		0.011	21.0	<0.05
	7.0		0.020	20.0	<0.05
	14.0		<0.01	22.0	<0.05
	23.0		0.036	48.0	0.51
#2 (Coal Mine Brook)	0.0	3.29000	0.027	48.0	<0.05
#3 (North Inlet)	0.0	4.35000	0.036	24.0	<0.05
#4 (Regatta Point Park)	0.0	5.68000	0.027	20.0	<0.05
#5 (Tilly Brook)	0.0	6.75000	0.015	8.0	<0.05
#6 (Quinsigamond Shores)	0.0	18.20000	0.012	22.0	<0.05
#7 (Jordan Pond inlet)	0.0	not tested	<0.01	20.0	<0.05
#8 (Lake Park Beach)	0.0	5.74000	<0.01	21.0	<0.05
#9 (O'Hara's Brook)	0.0	7.36000	0.013	36.0	<0.05
#10 (South deep hole)	composite	18.90000			
	0.0		<0.01	20.0	<0.05
	7.0		0.029	22.0	0.12
	14.0		0.015	23.0	0.11
	23.0		0.261	35.0	1.90
#11 (Billings Brook)	0.0	18.30000	0.036	30.0	0.05

TABLE 2

Lake Quinsigamond, 8/31/94

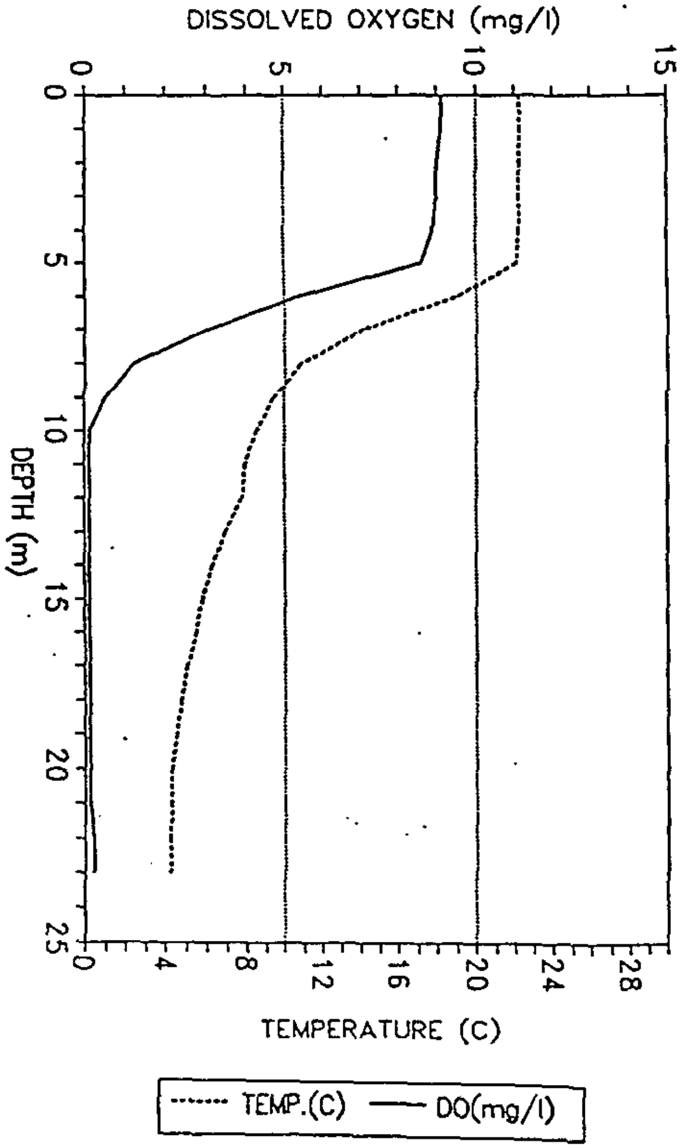
Sampling Station	DEPTH (m)	TEMP. (C)	DO(mg/l)	Sp. Cond.(mS/cm)	pH
#1 (North deep hole)	0.0	22.2	8.7	336	7.1
	1.0	22.3	8.6	337	7.1
	2.0	22.3	8.6	336	7.2
	3.0	22.2	8.6	337	7.2
	4.0	22.2	8.6	337	7.2
	5.0	22.2	8.6	337	7.2
	6.0	19.9	5.7	344	7.0
	7.0	15.5	4.2	424	6.6
	8.0	11.5	3.5	447	6.4
	9.0	9.0	1.8	471	6.3
	10.0	7.3	1.1	489	6.2
	11.0	6.5	0.6	495	6.2
	12.0	6.1	0.2	496	6.2
	13.0	5.7	0.2	497	6.2
	14.0	5.7	0.1	497	6.2
	15.0	5.6	0.1	499	6.2
	16.0	5.5	0.1	499	6.2
	17.0	5.4	0.0	499	6.2
	18.0	5.4	0.0	500	6.2
	19.0	5.3	0.0	502	6.2
	20.0	5.3	0.0	505	6.2
	21.0	5.2	0.0	510	6.3
	22.0	5.2	0.0	519	6.2
	22.5	5.1	0.0	525	6.4
#2 (Coal Mine Brook)	0.0	16.3	9.4	790	7.4
#3 (North Inlet)	0.0	20.3	3.9	245	7.0
#4 (Regatta Point Park)	0.0	22.5	11.1	343	8.7
#5 (Tilly Brook)	0.0	19.3	9.3	263	7.3
#6 (Qunisigamond Shores)	0.0	22.1	7.2	360	7.2
#7 (Jordan Pond inlet)	0.0	20.2	9.1	322	7.5
#8 (Lake Park Beach)	0.0	22.4	9.5	367	7.0
#9 (O'Hara's Brook)	0.0	16.7	8.8	494	7.0
#10 (South deep hole)	0.0	22.2	9.1	359	7.2
	1.0	22.3	9.1	359	7.2
	2.0	22.2	9.0	359	7.1
	3.0	22.2	9.0	358	7.0
	4.0	22.2	8.9	359	6.9
	5.0	22.1	8.6	359	6.7
	6.0	18.9	5.3	388	6.4
	7.0	14.1	3.0	434	6.3
	8.0	10.8	1.2	448	6.3
	9.0	9.4	0.5	453	6.3
	10.0	8.5	0.1	459	6.4
	11.0	7.9	0.1	462	6.4
	12.0	7.7	0.1	461	6.4
	13.0	6.8	0.1	475	6.5
	14.0	6.2	0.1	499	6.5
	15.0	5.7	0.1	523	6.6
	16.0	5.5	0.1	541	6.6
	17.0	5.0	0.1	574	6.6
	18.0	4.7	0.1	594	6.7
	19.0	4.5	0.1	619	6.7
	20.0	4.3	0.1	640	6.7
	21.0	4.3	0.1	681	6.8
	22.0	4.2	0.2	709	6.8
	23.0	4.2	0.2	720	6.7
#11 (Billings Brook)	0.0	16.1	6.8	250	6.9

FIGURE 4

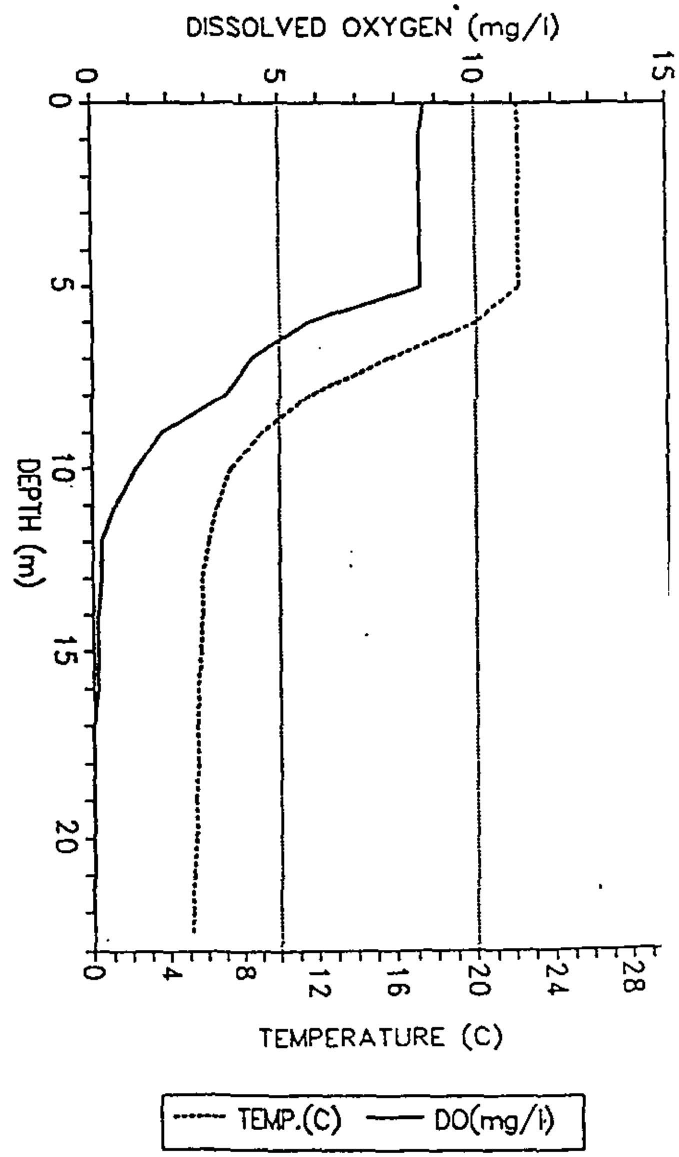
LAKE QUINSIGAMOND
Worcester/Shrewsbury, MA

Dissolved Oxygen/Temperature Profiles, 8/31/94

South Basin - Deep Hole



North Basin - Deep Hole



Massachusetts Department of Environmental Management
Division of Resource Conservation
Lake and Pond Management Program

MACROPHYTE OBSERVATIONS - TALLY SHEET

LAKE/POND: Lake Quinsigamond - North Basin

Date: 9/30/94 Collectors: Baecker/Lagacy

Macrophyte Species	Station #																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					
1. Myriophyllum sp.						x	x	x	x	x	x				x														
2. Nymphaea sp.														x	x	x													
3. Pontederia cordata															x	x													
4. Typha latifolia															x	x													
5. Lemna sp.							x							x	x	x													
6. Potamogeton sp.	x						x		x	x	x			x	x		x						x	x					
7. Brasenia Schreberi															x														
8. Lythrum Salicaria															x	x													
9. Elodea sp.					x													x		x		x		x					
10. Vallisneria americana	x				x					x	x		x	x			x	x		x	x	x							
11. Myriophyllum spicatum								x	x	x				x			x												
12. algal clumps					x		x	x			x	x	x		x														
13.																													
14.																													
15.																													
16.																													
17.																													
18.																													
19.																													
20.																													
21.																													

Massachusetts Department of Environmental Management
Division of Resource Conservation
Lakes and Ponds Program

MACROPHYTE OBSERVATIONS - TALLY SHEET

LAKE/POND: Lake Quinsigamond - South Basin

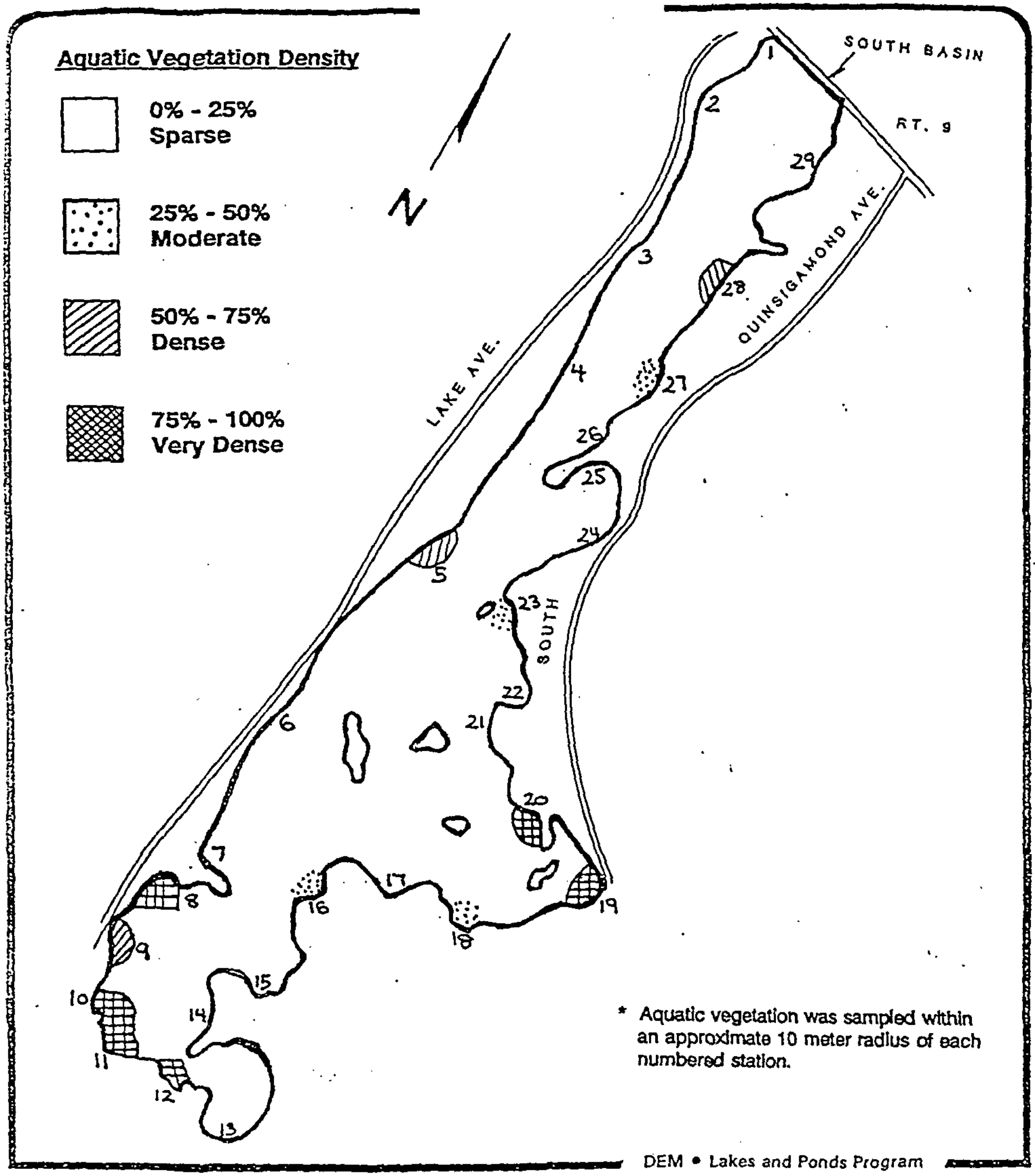
Date: 9/30/94 Collectors: Hartzel/Asen

Macrophyte Species/Common Name Station #

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1. *Najas flexilis*	x		x		x		x	x	x	x		x	x								x	x							
2. Potamogeton Robbinsii	x	x						x										x	x				x						
3. Potamogeton sp.	x	x			x			x	x	x		x	x					x	x									x	x
4. Myriophyllum spicatum		x	x							x								x	x	x			x		x	x	x	x	x
5. Ceratophyllum demersum		x																											
6. Vallisneria americana		x	x	x	x		x	x	x	x		x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x
7. Sagittaria sp.		x							x			x							x	x			x		x				
8. Nitella flexilis			x				x																						
9. Pontederia cordata																		x											
10. Spartina sp.																			x										
11. Cabomba caroliniana													x																
12. Myriophyllum sp.													x																
13. Nymphaea sp.																		x	x										
14. Typha latifolia																			x										
15. *Algal clumps*												x						x	x										
16.																													
17.																													
18.																													
19.																													
20.																													
21.																													

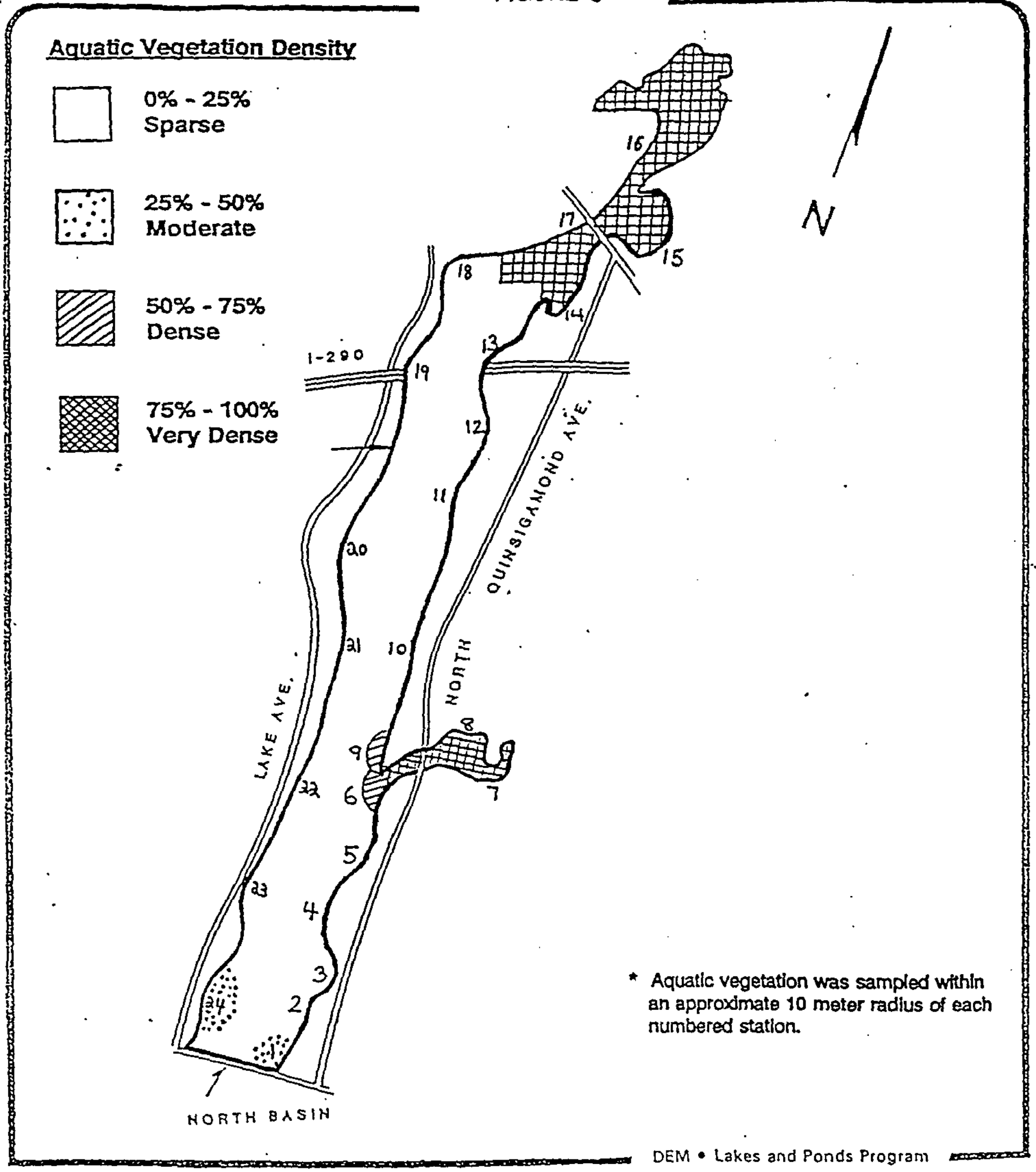
Appendix E
Test Results of the Distribution of Vegetation
In Lake Quinsigamond

FIGURE 6



Aquatic Vegetation Distribution 8/30/94	Lake Quinsigamond - South Basin Worcester/Shrewsbury - 772 Acres (Total Lake)

FIGURE 5



Aquatic Vegetation Distribution 8/30/94

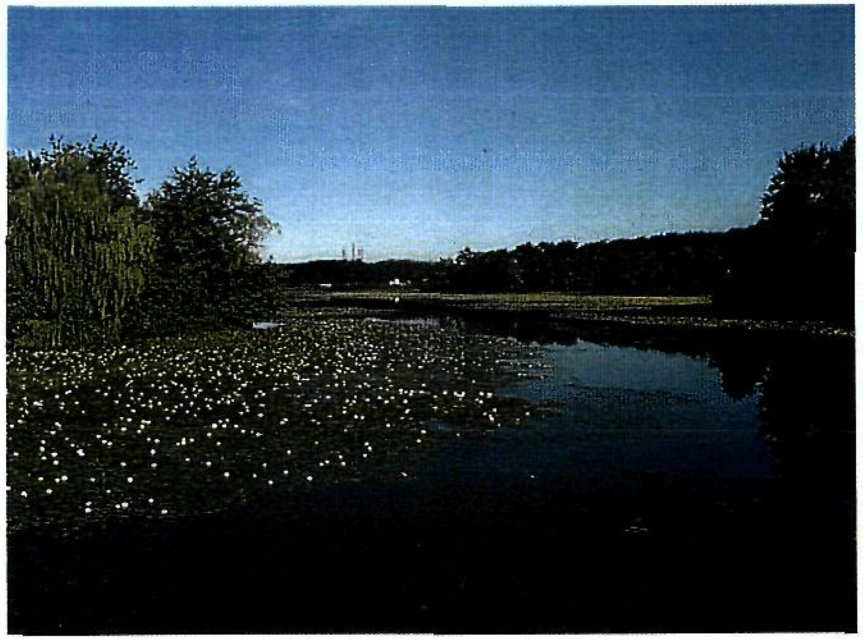
Lake Quinsigamond - North Basin

Worcester/Shrewsbury - 772 Acres (Total Lake)

draft 10/21/99
✓ w/ Pam Harvey
WCRC OPCD

Lake Quinsigamond/Flint Pond Feasibility Study

Presentation of Project Approach

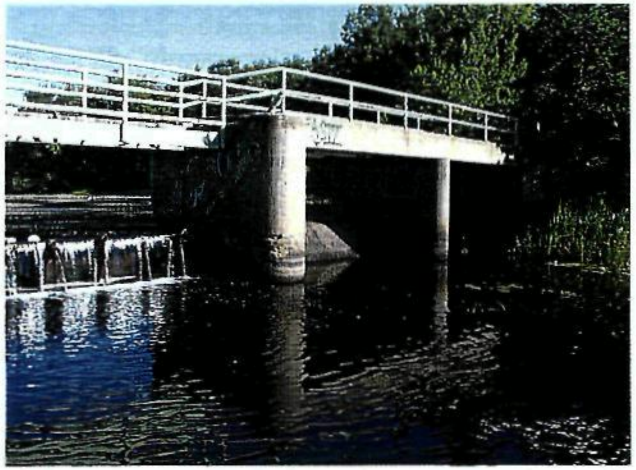


Hydrologic/Hydraulic Design Issues

- **Outflow Control Parameters**
  - **Irish Dam**
  - **Bridge at Creeper Hill Road**
  - **Bridge at Conrail Tracks**
  - **Hovey Pond Dam**
- **Inflow Control Parameters**
  - **Route 20 Bridge (allow for flood passage)**
  - **Route 20 Culvert (allow for flood passage)**
  - **Stringer Dam**

Hydrologic/Hydraulic Design Issues (continued)

- **Hydrologic Modeling**
  - **Watershed Delineation and Drainage Patterns**
  - **HEC-1 Rainfall/Runoff Model**
  - **Streamflow/Pond Fluctuation Evaluation**
- **Hydraulic Control Options**
  - **Irish Dam:**
    - **Notch Spillway**
    - **Operation of Bascule Gate**
  - **Other Outflow Modifications**
  - **Hydraulic Separation of Lake Quinsigamond & Flint Pond (allow for passage of flood waters)**



Some Advantages and Disadvantages of Lake Drawdown

Advantages:

- **May facilitate other management techniques by compacting and exposing sediment (e.g., bottom barriers or dredging)**
- **May be easily repeated after installation of control structures**
- **Low cost relative to many other management techniques**

Disadvantages:

- **Species-specific: Variable effects on nuisance species (e.g., decreases Coontail, Water Lily & Milfoil; increases Hydrilla *sp.* and Bushy pondweed; variable effects on Common Elodea & Cattail)**
- **Reduces benthic invertebrate abundance**
- **O_2 may become depleted in remaining pool (possible fish kills)**
- **May impact plants and animals in wetlands adjacent to the pond**
- **May result in post-drawdown algal blooms due to nutrient release from sediment**

Potential Effectiveness of Drawdown

1. Aerial Extent of Sediment Exposure
   - Bathymetric Map of Flint Pond
   - Predicted Drawdown Elevation Based on Outflow/Streamflow Parameters

2. Sediment Characteristics
   - Sediment Water Content and Grain Size
   - Sediment Characteristic Map
   - Sediment Thickness Map (potential consolidation)

Potential Effectiveness of Drawdown (Continued)

3. **Plant Community Issues**
   - **Map of Plant Species**
   - **Effectiveness of Drawdown on Nuisance Plants Present**
   - **Effects on Desirable Plant Communities (Bordering Wetlands)**

4. **Adverse Impact/Mitigation**
   - **Baseline Water Quality (e.g., temperature, D.O.)**
   - **Deep Hole Refuge for Fish; Maintenance of O2 During Drawdown**
   - **Presence of Rare or Endangered Species**
   - **Physiochemical Alterations of Sediment/Potential Impact on Water Quality**

Other In-Lake Management Techniques

- **Mechanical Harvesting/Hydroraking**
- **Herbicide Treatment**
- **Benthic Barriers**
- **Sediment Removal**

Bio controls

REGULATORY REQUIREMENTS FOR THE FEASIBILITY STUDY

The Wetlands Protection Act Regulations (310 CMR 10.00) Interim Technical Guidance 90-TG1, "Review of Lake and Pond Drawdown Projects for Aquatic Plant Control under 10.53(4)" requires that the following issues be addressed prior to issuance of an Order of Condition for drawdown projects:

ISSUE

- Must estimate total area and depth zones to be dewatered; verify the presence of a deep pool with sufficient D.O. to prevent fish kills; provide drawdown/refill dates; Provide estimates of downstream flow rates during refill
- Provide a list of target plant species and verify that drawdown will control target species
- Assess impacts to groundwater-fed bordering wetlands
- Assess potential positive and negative impacts to fish habitat (breeding habitat, food resources, cover, etc.) including freshwater shellfish
- Flood control and storm damage prevention must be discussed
- Must demonstrate that the project will not adversely effect rare wildlife species habitat
- Must assess pollution prevention: productivity, nutrient cycling, sediment inputs, algal blooms, downstream water quality impacts. Should obtain a 401 Water Quality Certificate.
- Ensure that upstream and downstream flow rates will be sufficient to maintain fisheries
- Must provide Alternatives Analysis and demonstrate that the project will improve "the natural capacity of a resource area to protect the interests of the Act (310 CMR 10.53(4))".
- Assess impacts to groundwater and shallow drinking water wells
- Discuss potential impacts to wildlife (mammals, waterfowl, invertebrates, amphibians, reptiles)
- Potential impacts to public or private wells or water supply intakes
- ENF notification based on area altered (dewatered)

EIR -